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(66) References to other related national documents:

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(54) Vertebral Joint Facets Prostheses

(57) The invention relates to a device for replacement of all or a part of the posterior vertebral articular process (3, 13), engaging a support (7) and means for anchoring with respect to the vertebra; characterized in the each complete prosthesis (5 and 15) or partial prosthesis (1 and 11), upper prosthesis (1, 5) and/or lower prosthesis (11, 15) represent the anatomical shape of the posterior vertebral articular process, comprising artificial sliding surfaces (2, and 12), facing one another between at least two adjacent vertebrae, while adapting to the physiological orientation; in that the anchoring means comprise a support (7) having a convex surface matching and engaging at least one portion of the concave surface of the posterior arch of the vertebra at least on one side of the spinous process (9); and in that the same anchoring means rigidly connect at least one separate portion of the support (7) to a corresponding separate portion of the vertebra.

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VERTEBRAL JOINT FACETS PROSTHESES

The invention relates to devices for replacement of articular surfaces of posterior vertebral joint facets, affected by a more or less serious degeneration, and to devices for anchoring of these prostheses on the vertebrae.

With respect to degeneration of vertebral articular surfaces, arthroses of the joint facets occur, which is manifested by a reduced thickness of the cartilage and may advance to the entire disappearance of the cartilage. Moreover, on the periphery of the eroded joint surfaces, there is a bony formation which can cause neurological compression either in the foramenae or in the spinal canal. These phenomena are responsible for lower back and nerve roots pain, affecting a large part of the population.

A degenerative process, which is most frequently experienced, usually affects only joint surfaces, but it may also involve a more invasive traumatic, infectious, tumoral or malformative process including the destruction of all or a part of the articular process.

It is therefore necessary to reduce and/or suppress frictions on degenerated articular surfaces: up until now, this aim has been achieved either by fixing all movement of the vertebrae affected by arthrosis or vertebral fusion which are more or less associated with an osteosynthesis (Harrington, Cotrel-Dubousset, TSRH, New Orleans, etc.), or by reducing the movements with spinal ligamentoplasty (Graaf, Senegas, Lemaire, etc.).

The locking of intervertebral movements by spinal arthrodesis or ligamentoplasty induces, in addition to vertebral rigidity, a transfer to the articular facets of adjacent vertebrae above and below the fusion, which are usually sustained by the intervertebral space in question, and therefore an increase of the degeneration of these joint facets.

With regard to discal prostheses, they provide a "space" between two vertebral bodies, while permitting some motion. While they provide a solution for the problem of aging of intervertebral disks, they have no effect on the reduction of the stress created in posterior articular facets whose motions and the frictions are maintained.

That is why the invention aims to mitigate the disadvantages of all known devices by providing a new device,

which makes it possible to realize replacement of degenerated articular surfaces with articular prostheses. These prostheses will preserve the intervertebral mobility, while canceling the "bone-cartilage" frictions of used up surfaces, and thus the pain and/or osteophytic induction which occurs with nerve root compression in foramenae.

The invention further relates to elements for treatment of articular surfaces for a total replacement of the entire bony process and its articular surface. The invention aims to preserve the stability of the vertebral column with intervertebral "hooking" of the process prosthetic devices between them, while respecting potential functional mobility and without altering the muscle-ligament paravertebral system.

According to the invention, these prosthetic devices, constructed from biocompatible materials such as metallic alloy (stainless steel, titanium, or other) and/or composite material, have a first "articular" surface, which is in contact with a similar surface of the adjacent vertebra to realize sliding with a minimum friction, and a second surface, opposite said "bony" porous surface provided with scattered protruding points, coated or not coated with hydroxy apatite, for resting on the remaining bone of the vertebral articular process. Therefore, according to the invention, these prosthetic elements replace at least the articular surfaces of one intervertebral space according to lower overlying joint facets of the upper vertebra and to upper joint facets of the underlying lower vertebra. If necessary, the prostheses can be unilateral, but they are, more often than not, preferably bilateral.

According to the invention, if the remaining bone of the articular process is too weak, the prosthesis replaces the entire process and thus always a sliding "articular" surface, but the usually "bony" opposite surface is replaced by a thickening of the prosthesis, so as to replace completely the articular process. The surface is therefore smooth and slightly convex to eliminate any risk for medullary or neurologic elements present within and in the front.

The invention also aims to mitigate anchorage difficulties due to the weak bony capital represented by each articular facet by providing an anchoring device for a vertebral facet prosthesis, comprising at least one support carrying a means for linking the prosthesis to this support, and anchoring means for the support with respect to the vertebra, characterized in that this support comprises a convex surface, which fits and bears with contact against at least one portion of the concave surface of the posterior arch of the vertebra, on at least one side of the spinous process, wherein the anchoring means rigidly links at least one distinct portion of the support with at least one distinct corresponding part of the vertebra.

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According to the invention, the device comprises at least one support, having a convex face extended with respect to the spinous process and/or a transverse process and/or one pedicle of the verterbra, and means for anchoring support, respectively, on the spinous process and/or a transverse process and/or one pedicle of the vertebra. The intrapedicular screw, when not used alone, is not obligatory and can therefore also be replaced with a simple short screw passing through the posterior cortex and stopping in the spongy bone facing the pedicle: this prevents any risk of neurological lesion.

According to the invention, each support is formed by a plate carrying coupling means and covering a portion of the concave surface of the posterior arch of the vertebra on at least one side of the spinous process.

A device according to the invention can have two supports, one on each side of the spinal process of the vertebra, or a single support extended from one side, or on two sides of the spinous process. Advantageously and in accordance with the invention, the two supports are linked together to the same spinous process by common anchoring means. The spinous process, whose cortical part is left completely unaffected, is thus supported and therefore provides support and unites the two bilateral supports. The two sides of the posterior vertebral arch can be used for anchoring, including also a unilateral prosthesis.

According to the invention, the means for anchoring of each support has at least one hook for the transverse bony process, which is articulated on the support about an axle, wherein the hook carries a clamping screw fitted into a threaded hole in the hook. This screw is supported either directly or indirectly on the support or on another hook to cause the hook to pivot about its axle in the direction in which the free end of the hook is clamped on the corresponding part of the vertebra. Advantageously and in accordance with the invention, the anchoring means include at least one clamping claw formed by two hooks articulated about the same axle or about two parallel axles whose free opposing ends are mutually clamped toward each other.

According to the invention, the anchoring means of each support includes at least one flange for clamping one end of the support on one vertebral process, namely on a spinous and/or transverse process.

In addition, according to the invention, the convex surface of the support is formed from a porous metal and is advantageously coated with a hydroxy apatite layer. This bony surface is covered with barbs scattered on it, which have circular or polyhedral profiles, with a height from 1 to 2 mm, and which serve to ensure a batter planting and fixation of the support on the cortical bone of the posterior vertebral arch.

The invention also relates to an anchoring device combining all or some of the characteristics mentioned above or below.

According to the invention, the linking means of the prosthesis has its support formed by the sessile base of this prosthesis (the base being in an upper or lower position), which thus establishes the link with the anchoring means on the vertebra.

Other characteristics, goals and advantages of the invention will become evident from the detailed description below, with reference to the attach figures, indicating:

- Figure 1 is a schematic rear view of an implanted vertebral prosthesis implementing bilaterally replacement of articular surfaces of upper and lower processes, showing a possible connection with the insertion of a dynamic vertebral prosthesis equipped with anchoring devices according to the invention.

- Figure 2 is a schematic sectional view through one horizontal plane of Figure 1, showing the upper prostheses and their means for anchoring on three points, which are the pedicles, and transverse processes and spinous processes, realized associated with an implanted dynamic vertebral prosthesis.

- Figure 3 is schematic rear view of one vertebral prosthesis, implanted in an insulated manner and fixed onto the three usual points of anchorage.

- Figure 4 is a schematic rear view of one vertebral prosthesis, implanted and fixed onto the vertebra by two usual anchoring points into the pedicles and on the spinous processes.

- Figure 5 is a schematic rear view of one vertebral prosthesis, implanted and fixed on the vertebra only with one intrapedicular screw from each side of the spinous process.

- Figure 6 is a schematic rear view of another embodiment, in which the vertebra has no spinous process: the plate is made of a solid type cast and provides a bridge between two paravertebral grooves, covering the rear of the spinal canal which is protected by this plate.

- Figure 7 shows a schematic upper view of a vertebral prosthesis, implanted at the level of the 12th thoracic vertebra which has no transverse processes, wherein one slanting screw stabilizes the prosthesis in the direction of the pedicle.

- Figure 8 show a schematic rear view of the prosthesis, implanted at the level of the 1st sacral vertebra with a cast solid plate anchored at the level of the pedicles and of their conjugation holes.

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According to the invention, the blade 1 of the upper facet prosthesis has the same direction as the joint which it replaces. At the lumbar level, the blade is in a vertical and slanted plane with respect to the frontal and/or sagittal plane. Its surface 2 faces the rear and the median direction. The angle of approximately 45° at the lumbar level is variable with respect to the considered vertebral level. At the dorsal and cervical level, the blade has a more frontal and slanted orientation with respect to the horizontal plane. Its surface 2 is thus directed toward the rear and above.

According to the invention, the shape of the blade 1 of the prosthesis is oval with a vertical major axis. Its surface 2 is generally flat but it may be slightly concave (in accordance with the slightly convex surface 12 of the blade 11 of the prosthesis of the lower articular process 13) to allow movement with some degree of rotation according to the considered vertebral level.

According to the invention, the blade 1 of the prosthesis replaces degenerated cartilage and thus rests against the remaining bone of the articular process 3. Its variable thickness, usually from 2 to 3 mm, may be of more importance if this is justified by the required force, and its non-articular porous surface 4 is to some extent coated with hydroxy apatite to enable a better fixation and integration of the remaining bone.

According to the invention, in the event that the fragility of the remaining bone or the lack of the bone justifies complete replacement of the process 3, the blade of the prosthesis is thickened so that it could support on itself all the needed strength and the anatomic form of the total considered process 13 is recovered: its articular surface 12 remains the same as that used for partial replacement, when the opposite face 5 is formed from full material by creating one smooth convex face 5, which serves as the internal and posterior limit of the spinal canal, and as the posterior limit of foramen.

According to the invention, the sliding surface 2 of this blade 1 of the prosthesis is coated with a biocompatible material with a high sliding rate (or a low friction rate) in a non-limiting manner, comprising stainless steel, titanium, ceramic material, polyethylene with a high molecular weight, or composite material.
The surface will articulate with the surface 12 (made from identical or different material) of the blade 11 of the lower articular prosthesis of the upper vertebra. Its dimensions correspond to those of the articular surface which it is replacing and they may be even reduced by 1 to 2 mm in the front to increase the frontal posterior foramen diameter and thus to avoid any nerve root compression.

According to the invention, the link of the blade 1 and of the prosthesis with its anchoring means is made with progressive widening of its base 6, which forms one solid bloc with its support 7.

This sessile base 6 is convex and porous on its rear surface for its application to and contacting with the bone of the vertebral arch on which it rests. The support 7 is applied with its matching contours against the rear surface of the vertebral posterior arch: this support or plate 7 is fixed to the bone at least by one of its anchoring means on the transverse process 8, spinous process 9 and/or the pedicle 10.

According to the invention, if the blade 1 of this upper prosthesis is placed on the inferior vertebra of the planned assembly, it stays isolated on this vertebra while using as necessary one or more planned means of anchorage. In the case, when this blade 1 of this upper prosthesis is placed on an "intermediary" vertebra of the assembly, it is then associated with the blade 11 of the lower prosthesis with which it forms one solid bloc with the support, which thus realizes the same vertebral fixing for the two prosthetic blades 1 and 11.

The blade 11 of the prosthesis of the inferior articular process 13, according to the invention, has the same orientation as the articular surface which it is replacing, that is to say it is situated in a vertical plane which is slanted with respect to the front and sagittal plane. The angle, approximately 45° at the lumbar level, is variable according to the considered vertebral level and stays strictly parallel to that of the blade 1 of the prosthesis of the superior articular process 3 of the lower vertebra 3 on which it will be matched to allow sliding with a minimum of friction.

According to the invention, the shape of the blade 11 of this prosthesis is oval with its major vertical axis. Its surface 12 is generally planar but it can be slightly convex to match the concavity of the blade 1 of the corresponding superior articular process 3. It is directed forward and outward to lean against the surface 2 of the blade 1 of the prosthesis of the superior articular process 3 of the lower vertebra. Its dimensions match those of the articular surface that it is replacing and they may even be reduced by 1 to 2 mm in the front to increase the frontal posterior diameter of the foramen and thus to prevent any nerve root compression.

According to the invention, similarly to the blade 1 of the prosthesis of the superior articular process 3, this prosthetic blade 11 of the inferior articular process 13 is leaning against the remaining bone of the articular process 13 or it replaces completely this articular process 13. Its bony face 14 and its articular surface 12 are comparable to those of the blade 1 of the prosthesis of the superior articular process 3, fitted to the anatomy of the considered vertebra.

According to the invention, in the event that the fragility of the remaining bone justifies total replacement of the inferior articular process 13, the blade 11 of the prosthesis imitates the anatomic form of the inferior articular process 13: its articular surface 2 remains identical to that which is used for partial replacement when the opposite face is made with full material forming one smooth convex surface,

which serves as an internal and posterior limit of the spinal canal and as a posterior limit of the foramen.

According to the invention, the blade 11 is joined with the inferior articular process by the anchoring means by widening in a sessile base 16 which is superior and makes an external wrapping motion around the bony base of the inferior articular process 13, which occupies a posterior and medial position in relation to the blade 11 of the prosthesis of the inferior articular process 13.

Advantageously and according to the invention, in the event that two prosthetic blades, namely superior 1 and inferior 11, are desired on one identical vertebra, they make one “solid block” with the support anchoring vertebral support 7 which is common: this results in a reinforcing effect on their stability because they use the same fixing means.

When the prosthetic blade 11 of the inferior articular process 13 is implanted on the most superior vertebra of the selected assembly, it is fitted in an isolated manner on this vertebra and thus it is supported by its superior sessile base 16 on its support 7, which provides it with vertebral anchoring on at least one of three points, which are transverse process 8, spinous process 9, and the pedicles 10

Advantageously and according to the invention, the prosthetic blades 1 and 11 of the posterior vertebral articulations may be implanted in an isolated way or associated with one vertebral internal dynamic orthosis and/or with one or several prostheses of intervertebral disc prostheses, which will reduce the force applied to these articular prostheses.

According to the invention, the anchoring devices of the prosthetic blades 1 and 11 comprise supports 7 and the anchoring means on at least one separate portion of each vertebra. In this manner, each support or plate 7 of the anchoring means is extended with respect to the pedicle 10 of the vertebra, and my be anchored to the vertebra on at least one pedicle 1- with an intrapedicular screw 17 with a milled head fitted into the corresponding perforation 18 of the plate 7 According to the evaluation of the neurologic risks, the intrapedicular screw 17 may be very short, and it is always directed toward the pedicle 10, but limited in depth to the posterior arch cortex and to the spongy bone underlying with respect to the pedicle 10, but without penetration into the latter to avoid any protrusion in the spinal canal or foramen.

Each plate 7 of the anchoring means is also advantageously extended with respect to the lateral surface of the spinous process 9, from each side, and comprises also anchoring means on this spinous process 9. To achieve this, the end 19 of the plate facing spinous process 9 has one bulge 20 projecting in the frontal plan and in the horizontal direction

so as to form a shoulder for retaining an encircling arrangement which may be formed from a self-locking collar 21, made of metal or of synthetic material, or one flange 22, surrounding the spinous process 9 and clamping the end of the plate 19. The flange 22 can consist of one frame surrounding the spinous process 9 and the end of the plate 19, of a screw 24, which has a vertical axis and which is fitted through a vertical threaded hole of the frame 23, and whose free end is equipped with a shoe 25 which is supported on the upper surface of the spinous process 9. In this manner, the frame 23 is blocked with respect to the spinous process 9. The flange 22 also comprises a screw 26 having a horizontal axis which is frontally fitted in a horizontal threaded hole of the frame 23, and whose free end is equipped with a shoe 27 which is supported on the free end 19 of the plate to provide lateral and horizontal clamping against the spinous process 9. After the screw 26 has been tightened, the retaining shoulder formed by the bulge blocks the flange 22 in horizontal transmission with respect to the free end 19 of the plate, the shoe 27 coming up forward and against this bulge. The flange 22 links together the two plates 8 and thus constitutes common anchoring means of these two plates 7 to the spinous process 9 of the vertebra.

Similarly, each plate 7 of the anchoring devices is extended facing at least one transverse process 8 of the vertebra, and comprises means for anchoring on one transverse process 8. This anchoring means may be formed by at least one hook 28 (left plate in Figure 6), which is articulated at the transverse end 29 of the plate 7 about a horizontal axis 30 and which is supported on the upper surface and/or on the lower surface of the transverse process 8. The transverse end 29 of the plate 7 thus provides, for each hook 28, a yoke 31 in which the hook 28 is articulated about its axle 30. Each hook 28 is equipped at its end opposite the transverse process 8 with a vertical screw 32, which is fitted into a threaded hole of the hook 28 and supported on one horizontal surface at the of the bottom of the yoke 31 of the plate 7 in order to clamp this hook 28 against the corresponding surface of the transverse process 8.

In Figure 6, the means for anchoring the plate 7 on the right side comprise a clamping claw 33, formed from two hooks 34 and 35, articulated with respect to the plate 7 about two parallel horizontal axles 36 and 37. In a variant, the anchorage onto the transverse process 8 can be realized with a self-locking clamping collar 39 (similar to the collar 21 used on the spinous process 9), made of metal or synthetic material. Each hook 34 and 35 is similar to the hook 28 described above, and it is mounted in each yoke 40 and 41 of the plate 7, each with a vertical clamping screw 42 and 43, which is supported on one horizontal surface of the bottom of the yoke 40 and 41 in order to clamp this hook 34 and 35 against the surface corresponding respectively to the upper and lower process 8. The respective free ends 44 and 45 of the two hooks are extended in the opposite direction with respect to each other and they clamp each other due to the effect of the screw 42 and 43 to imprison the transverse process 8. Instead of the two screws 42 and 43, it is possible to provide a tightener which has two reversed screw stages, which links the two hooks 34 and 35 to each other

and which is accessible from the top or from the bottom in order to clamp or unclamp the two hooks 34 and 35. Such a claw can be provided also for the plate 7 on the left side.

Figure 6 represents a variant of an embodiment in which the plate 7 is extended in the two paravertebral grooves, the verterbra not having any spinous process. The plate 7 is anchored onto the two transverse processes 8 and onto the two pedicles 10. The plate forms a bridge covering the posterior vertebral arch and protecting the spinal canal.

Figure 4 represents another variant in which the plates 7 are anchored only by the intrapedicular screws 17 and by the flange 22 onto the spinous process 9.

Figure 5 represents another variant in which the plates 7 are anchored only by the intrapedicular screws.

Figure 7 represents another embodiment form, which is specifically designed for dorsal vertebra D12, which generally has no transverse processes. Each plate 7 nevertheless fits the shape of the stump of the transverse process 8 on which it is fixed with a slanted screw 46 oriented in the direction of the pedicle 10. The plates 7 are thus fixed by the intrapedicular screws 17 and by one clamping flange 22 on the spinous process 9.

Figure 8 represents the case of the sacral vertebra S1, which does not have transverse processes but does have a sacral ala, using one plate 7 as a single, continuous plate extending on both sides of the hypotrophic spinous process 9, while forming a bridge above this spinous process 9. The plate 7 may be anchored by two lower hooks 47, which are similar to the hooks of the transverse processes 28 described previously, and which are supported on the upper edges of the two first sacral holes. Each hook 47 is clamped by a clamping screw 47, which is fitted into the threaded hole of the hook 47 and supported on a vertical surface of the plate 7. The plate 7 is fixed on the vertebra S1 by two intrapedicular screws 17 passing through the orifice 18 provided in the plate and guided within the vertebral body toward the upper plateau of S1. The two other screws (not shown) can stabilize the plate by fixing it laterally to the sacral ala.

The surgical technique for fitting this prostheses is the technique which is used for conventional posterior spinal surgery with an opening of the 2 paravertebral muscular grooves while keeping the intervertebral ligament system intact.

The joints are opened with an ablation of the articular capsules, followed by the remaining bone and cartilaginous surface of the vertebral facets. The marginal osteophytes are resected mainly for a recalibration in front of the foramen and inside the spinal canal to eliminate in this manner any neurological root compression,

such as in the case of a narrow lumber canal. If the resection of the bone required for the insertion of the prosthesis leaves a process stump that is too fragile, it is preferable to carry out its ablation and then to insert one total articular process prosthesis.

The total prosthesis or only joint prosthesis of the vertebral facet is thus selected as a function of the treated level, and positioned; its dimensions and its orientation are verified so as to correspond well to those the will be placed opposite.

The anchoring is carried out, as a function of the encountered anatomical conditions, according to the different combinations with the three anchoring points which are the spinous processes, the transverse processes and the pedicles. According to an evaluation of the neurological risk, said "intrapedicular" screw may be very short and limited to the posterior cortex and the spongy underlying bone, facing the pedicle without penetration into it, in order to avoid any protrusion in the spinal canal or the foramen: it is thus joined most frequently with an anchorage onto the transverse and/or spinous process to ensure the stability of the assembly.

The intervention is finished by closing the site that has been operated upon, or it may be extended when a rachidian dynamic instrument is deployed in order to reduce the pressure placed on these joint facet prostheses and other paravertebral structures. Eventually, depending on the case, the intervertebral discs may benefit from the deployment of disc prostheses allowing to reduce the pressure applied in the anterior of the vertebral column (and thus partially to posterior joint facets), while preserving the highest possible level of mobility.

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CLAIMS

1/ - A device for replacement of all of or of a portion of vertebral articular processes, superior (3) and inferior (13), and of articular surfaces of these processes, supported on supports (7) and its anchoring means with respect to the vertebra, preserving the mobility of the vertebra between them and the stability of the column, for treatment of degenerative lesions, but also traumatic, tumoral or infectious lesions of these processes, characterized by the fact that it comprises at least two prosthetic blades, unilateral or bilateral, one blade (1) of the superior prosthesis of the inferior vertebra opposite to the blade (11), and the inferior prosthesis of the superior vertebra, each, total, or partial, imitating the anatomic forms and the orientation of articular vertebral processes (3 and 13), whose sliding surfaces (2 and 1) are located opposite each other to permit various movements, wherein the anchoring means comprise at least one of the supports of the prosthesis or a plate (7), whose one convex surface fits and is supported in contact with a portion of at least the concave surface of the posterior arch of the vertebra from one side, at least of the spinous process (9), and wherein the same anchoring means rigidly link at least one separate portion of one of the supports (7) with a corresponding separate part of the vertebra.

2/- The device according to claim 1, characterized by the fact that the two blades (1 and 11) are generally planar, but can be concave in superior position, or convex in inferior position, and have the same form, the same position and the same orientation as the articular surfaces of the vertebral posterior processes superior (3) and inferior (13) which they are replacing.

3/- The device according to claim 1 and 2, characterized by the fact that the blades (1 and 11) provide a surface opposite the sliding surface, which is smooth and convex, limiting internally the spinal canal and in the rear the foramen, designed to strengthen the thickness of the blades (1 and 11) with the replacement of all of the vertebral articular posterior processes (3 and 13).

4/- The device according to any of the preceding claims, characterized by the fact that it comprises two sessile bases, one superior (6) and the other inferior (16), which establish the link of the prosthetic blades (1 and 11) and one of their anchoring supports (7), while fitting the form of the vertebral posterior arch on which they are supported on their porous surfaces.

5/- The device according to the claim 1, characterized by the fact that it comprises at least one support (7), whose convex support is extended with respect to the spinous process (9) of the vertebra, comprising anchoring means of this support (7) on the spinous process (9) of the vertebra.

6/- The device according to the claim 1 and 5, characterized by the fact that it comprises at least one support (7), whose convex surface is extended with respect to at least one transverse process (8) of the vertebra, which comprises anchoring means of this support (7) at least on one transverse process (8) of the vertebra.

7/- The device according claims 1, 5 and 6, characterized by the fact it comprises at least one support (7) whose convex surface is extended with regard to at least one pedicle (10) of the vertebra, comprising anchoring means of this support (7) with respect to at least one pedicle (10) of this vertebra.

8/- The device according to the claims 1, 5, 6 and 7, characterized by the fact that it comprises at least one of the supports (7), whose convex surface is extended with regard to at least two or three anchoring points, which are the transverses processes (8), pedicles (10) and spinous processes (9), comprising anchoring means of this support (7) with respect to at least two or three corresponding anchoring points on the vertebrae.

9/- The device according to one of the preceding claims, characterized by the fact that it comprises two supports (7), one on each side of the spinous process (9).

10/- The device according to the claims 8 and 9, characterized by the fact that the two supports (7), deployed on each side of the spinous process (9) are linked together with this spinous process (9) by common anchoring means.

11/- The device according to any of the preceding claims, characterized by the fact that the anchoring means of one of the supports (7) comprise at least a hook (28, 34, 35), articulated on this support (7) about an axis (30, 36, 37), wherein this hook (28, 34, 35), carries a clamping screw (28, 34, 35), fitted in a threaded hole of the hook (28, 34, 35), wherein the screw is supported directly or indirectly on said support (7) or on another hook, so as to cause pivoting of the hook (28, 34, 35) about its axis (30, 36, 37) in the clamping direction of its free end (44, 45) on the corresponding part of the vertebra.

12/- The device according to any of the preceding claims, characterized by the fact that the anchoring means of one of the supports (7) comprise at least one clamping claw (33) formed from two hooks (34, 35), whose tow free ends (44, 45) are mutually clamped towards one another.

13/- The device according to any of the preceding claims, characterized by the fact that the anchoring means of one of the supports (7) comprise at least one flange (22) and/or one clamping collar (21, 39) of one end (19, 29) of said support (7) on one vertebral process (8, 9).

14/- The device according to any of the preceding claims, characterized by the fact that each support (7) is formed from a plate carrying a coupling means (49) of a rachidian instrument.

15/ - The device according to any of the preceding claims, characterized by the fact that the surface of the bony support of the prosthetic elements (1, 11, 5 and 15) and/or of the supports (7) may be also formed from a porous metal covered with barbs scattered on it.

16/ - The device according to any of the preceding claims, characterized by the fact that the surface of the bony support of the prosthetic elements (1, 11, 5 and 15) and/or of the supports (7) may be also coated with a hydroxy apatite layer.

Figure 1 ~ Figure 8

(19) French Republic	Preliminary Search Report	**2 721 501**
——	NATIONAL INSTITUTE FOR INDUSTRIAL PROPERTY	FA 501987 FR 940774

Based on most recent claims registered before the search was initiated

DOCUMENTS CONSIDERED RELEVANT		Related claims of the examined application
Category	Citation of a document with the indication, when needed, of the relevant parties	
A	EP-A-) 408 489 (Sulzer Brothers) [German]	Technical domains researched
A	US-A-5 127 912 (Ray)	A61F A61B
A	FR-A-2 623 085 (Breard)	
A	EP-A-0 570 929 (PINA VERTRIEBS AG) [German]	

Date of completion of the search report: March 23, 1995

Examined by: Papone, F

Categories of Cited Documents:

A: Relevant at least to one encountered claim or to general technology according to prior art.